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## IX

# NOTES ON THE NORTHERN ELEPHANT SEAL

BY

M. E. McLELLAN DAVIDSON

*Assistant Curator, Department of Ornithology and Mammalogy*

After passing through various nomenclatural vicissitudes, the elephant seal of southern waters had apparently arrived at a certain permanence in *Macrorhinus leoninus* until the appearance, in 1909, of Lydekker's paper "On the Skull-Characters in the Southern Sea-Elephant."[1] Basing his studies on the skulls of two males from Macquarie Island, a male from Chatham Island, a female from the "Antarctic Seas," a male from the Crozet group, and an old male from the Falklands, Lydekker reached the conclusion that the differences found in the palatal regions of these specimens warranted the recognition of the following species and subspecies: *Macrorhinus leoninus typicus* [= *M. l. leoninus*] (Juan Fernandez); *M. l. falclandicus* (Falkland Islands), perhaps inseparable from the typical race; *M. l. macquariensis* (Macquarie and ?Chatham islands); and *M. croscensis* (Crozet and ?Kerguelen and Heard islands).

In this paper no attempt was made to discuss the cranial features of the Northern Elephant Seal, but Lydekker noted that the characters exhibited by the palatines of a skull of that form were sufficient for its recognition as a distinct species. In an appended note, resulting from a communication from

[1] P. Z. S. 1909, pp. 600-606.

Rothschild, it was remarked that should the northern species prove to be identical with that from Juan Fernandez and Chile, the specific name *leoninus* should be reserved for the animals of that region, and the elephant seals from the Falklands, and from Macquarie and Chatham islands should be known respectively as *M. falclandicus falclandicus* and *M. f. macquariensis*. The reason for this division is obscure in view of the statement that the Falkland Island race was perhaps inseparable from the typical *leoninus*.

Lydekker's paper proved but the prodrome of one by Lönnberg.[2] While recognizing the probability of a widely distributed species being separable into geographic races, Lönnberg found himself unable to accept Lydekker's conclusions. The characters upon which the latter's species and subspecies were founded (with the exception of the breadth of palate in the Crozet example), all fell within the range of variation exhibited by the series (seven adult and semi-adult males, three young males, and one adult female) from South Georgia examined by Lönnberg.

With a series of five males and four females from Guadalupe Island, one male from the Falklands, two or three from Macquarie, and two or three from Crozet Island at his disposal, Rothschild[3] continued the discussion. Although the promised article, giving the constant characters by which the various subspecies might be recognized, has not yet appeared, Rothschild confessed his faith in the validity of *Mirounga leonina leonina* (coasts of California and adjacent islands, wintering on Chilean coasts), *M. l. patagonica* (Falkland Islands, South Georgia, and ?South Shetlands), *M. l. kerguelensis* = *M. l. crozettensis* [*sic*] (Herd, Kerguelen, Crozet islands, etc.), *M. l. peronii* (islands of Bass Straits), and *M. l. macquariensis* (Macquarie Islands).

Apparently Rothschild was governed largely in his decision as to the unity of the species by a report from Harris "that he must reach the island [Guadalupe] before the middle of May or the Sea Elephants would have migrated to the south." Rothschild states that he "looked up the matter, and . . . found that, although a few stray individuals might formerly

[2] P. Z. S. 1910, pp. 580-588.
[3] Nov. Zool., XVII, pp. 445-446.

have led a pelagic life north of the Equator, the bulk of the Northern Sea Elephants migrated in the hot weather to the Chilean coast and the islands near (Juan Fernandez, Masafuera, etc.)," but the sources of his information are not revealed.

That rookeries are more or less completely deserted subsequent to the breeding season is hardly sufficient for the determination of a migration in any particular direction. Breeding grounds in the southern hemisphere (Kerguelen, South Georgia, and Macquarie, etc.) are similarly vacated after the season of reproduction, and the fact that elephant seals have been found in the Antarctic pack ice (65° 08′ S.)[4] and at Cape Royds (77° 40′ S.)[5] in January is evidence of a movement away from, rather than across, the equator.

Moreover, the information furnished by Harris was inaccurate. Scammon[6] found several cows and their young, the latter apparently but a few days old, on Santa Barbara Island in June, 1852. Townsend[7] reports finding a pup three weeks old on Guadalupe Island, October 9, 1883; and the new-born young he met with on the Lower Californian islands in 1883-84 were dropped at various times between November 1 and February 1. In 1911, he saw a dozen or more females with very young pups on March 5 at Guadalupe Island. In the Academy's collection are skull and skeleton of a pup a few weeks old taken on Guadalupe Island, May 8, 1914.

Reports from recent expeditions visiting Guadalupe Island during the summer months indicate the presence of a considerable herd at that season. The *Tecate* Expedition[8] reported the presence of 264 adult animals, July 12, 1922, and 300 four days later. Mexican officials visiting the island in early September of the same year found 150 females and an equal number of pups about 30 inches in length.[9] In 1923, 366[10] were counted on July 16, and on August 30 of the succeeding year

[4] Wilkes, C., Nar. U. S. Expl. Exped., II, p. 291.

[5] Wilson, E. A., Geog. Jour., XXV, p. 393; Nat. Antarctic Exped., N. H., Zool., II, p. 53.

[6] Marine Mammals of the North-western Coast of North America, p. 118.

[7] Proc. U. S. Nat. Mus., VIII, p. 93; Bull. Am. Mus. Nat. Hist., XXXV, p. 407.

[8] Hanna, Proc. Calif. Acad. Sci., 4th Ser., XIV, p. 229; Anthony, Jour. Mam., V, p. 146; Proc. Calif. Acad. Sci., 4th Ser., XIV, pp. 310, 313.

[9] Anthony, Proc. Calif. Acad. Sci., 4th Ser., XIV, p. 313.

[10] Huey, Science, n. s., LXI, p. 406; Anthony, Jour. Mam., V, p. 148.

124[11] occupied the beach. A total of 465 animals was found on the island on June 23, 1926.[12]

This evidence of an extended breeding season and the presence of a considerable herd of elephant seals in North American waters during all seasons seem to militate against the view of a migration of these animals to Juan Fernandez, especially as Anson[13] found elephant seals with young on that island during his stay, from June 10 to September 19. It is stated that the young were born during the "winter."

With a view to aiding in the determination of the status of the elephant seals of the north Pacific, the Academy's series of specimens has been examined. These examples apparently but inadequately represent the Guadalupe animals, skulls of greater length, two feet (605 mm.)[14] and 556 mm.,[15] having been known. It has been deemed advisable, however, to place the measurements on record, together with notes on structural characters.

In order to facilitate comparisons with previously published figures, percentages of basal length of skulls, in addition to the actual measurements, have been given in the appended table. The incomplete skulls appear to be those of adult males. The open pulp cavities of the canines and the condition of the sutures in the largest complete skull bear witness to the animal's immaturity, and even the skulls of the somewhat older females show that the possibilities of additional growth had not been exhausted.

Through the courtesy of Dr. Charles Anderson, Director of the Australian Museum, Sydney, and Mr. George P. Engelhardt, Curator of the Department of Natural Sciences, Brooklyn Museum, Brooklyn, an examination of the skulls of two adult males from Macquarie Island and one adult male from South Georgia has been made possible. The measurements of these specimens are given below.

In basal length the complete skulls of the males in the Academy's collection fall considerably short of those from

[11] Huey, Science, n. s., LXI, p. 406.
[12] Huey, Jour. Mam., VII, p. 160.
[13] *Cf.* Thomas, Jour. Voy. to the South Seas in 1740-44, p. 40.
[14] Townsend, Proc. U. S. Nat. Mus., VIII, p. 93.
[15] Huey, Jour. Mam., V, p. 241.

| | Males | | | | | | Females | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1133 | 4658 | 1136 | 963 | 879 | 1139 | 962 | 1137 | 1138 |
| Basal length | ..... | ..... | 440.00 | 405.00 | 347.00 | 306.00 | 353.00 | 328.00 | 223.00 |
| Zygomatic width | 349.00 | 321.00 | 299.00 | 277.00 | 240.00 | 209.00 | 214.50 | 218.00 | 170.00 |
| Zygomatic width in o/o of basal length | ..... | ..... | 67.95 | 68.14 | 69.16 | 68.00 | 60.76 | 66.45 | 76.23 |
| Length of palate | ..... | ..... | 228.00 | 214.00 | ..... | 140.00 | 172.00 | 148.00 | 91.00 |
| Length of palate in o/o of basal length | ..... | ..... | 51.81 | 52.83 | ..... | 45.75 | 48.44 | 43.90 | 40.80 |
| Width of palate | ..... | ..... | 138.50 | 127.30 | 111.75 | 96.25 | 101.00 | 99.75 | 71.75 |
| Width of palate in o/o of basal length | ..... | ..... | 31.47 | 31.43 | 32.20 | 31.45 | 28.61 | 30.41 | 32.17 |
| Length of interpalatine suture | ..... | ..... | 25.50 | 37.00 | 26.00 | 17.00 | 23.00 | 19.00 | 9.00 |
| Length of interpalatine suture in o/o of basal length | ..... | ..... | 5.79 | 9.14 | 7.49 | 5.55 | 6.51 | 5.79 | 4.48 |
| Length of premaxillaries in palatine surface | ..... | ..... | 90.50 | 85.00 | 66.00 | 62.50 | 66.25 | 58.50 | 38.00 |
| Length of premaxillaries in palatine surface in o/o of basal length | ..... | ..... | 20.56 | 20.98 | 19.02 | 20.42 | 18.76 | 17.83 | 17.04 |
| Width of occipital condyles | 131.00 | 117.00 | 109.00 | 106.50 | 98.50 | 94.00 | 97.00 | 94.40 | 85.50 |
| Width of occipital condyles in o/o of basal length | ..... | ..... | 24.75 | 26.29 | 28.38 | 30.71 | 27.47 | 28.78 | 33.85 |
| Width of skull at posterior edge of *meatus aud. externus* | 298.00 | 280.00 | 264.00 | 253.50 | 225.00 | 194.00 | 190.00 | 192.00 | 156.00 |
| Width of skull at posterior edge of *meatus aud. externus* in o/o of basal length | ..... | ..... | 60.00 | 62.59 | 64.84 | 63.39 | 53.82 | 58.53 | 69.95 |
| Width of skull on a level with the upper posterior premaxillary suture | ..... | ..... | 141.25 | 129.75 | 105.50 | 85.20 | 91.60 | 89.75 | 60.75 |
| Width of skull on level with the upper posterior premaxillary suture in o/o of basal length | ..... | ..... | 32.10 | 32.03 | 30.40 | 27.84 | 25.94 | 27.36 | 27.24 |
| Least frontal width of skull | 78.00 | 68.20 | 57.50 | 57.00 | 46.50 | 40.00 | 41.50 | 43.50 | 26.75 |
| Least frontal width of skull in o/o of basal length | ..... | ..... | 13.06 | 14.07 | 13.40 | 13.07 | 11.75 | 13.26 | 11.99 |
| Length of nasals | ..... | ..... | 72.00 | 65.00 | 51.25 | ..... | 56.50 | 49.75 | 41.00 |
| Combined width of nasals | ..... | ..... | 58.50 | 47.75 | 38.50 | ..... | ..... | ..... | 22.75 |

| | South Georgia | Macquarie Island | |
|---|---|---|---|
| Basal length | 505.00 | 475.00 | 465.00 |
| Zygomatic width | 381.00 | 355.00 | 352.00 |
| Zygomatic width in o/o of basal length | 75.44 | 74.73 | 75.69 |
| Length of palate | 280.00 | 253.00 | 263.00 |
| Length of palate in o/o of basal length | 55.44 | 53.26 | 56.02 |
| Width of palate | 175.00 | 173.00 | 168.00 |
| Width of palate in o/o of basal length | 34.65 | 36.42 | 36.12 |
| Length of interpalatine suture | 55.00 | 47.00 | 50.00 |
| Length of interpalatine suture in o/o of basal length | 10.89 | 9.89 | 10.75 |
| Length of premaxillaries in palatine surface | 103.00 | 115.00 | 104.50 |
| Length of premaxillaries in palatine surface in o/o of basal length | 20.39 | 24.21 | 22.47 |
| Width of occipital condyles | 136.50 | 108.50 | 120.00 |
| Width of occipital condyles in o/o of basal length | 27.02 | 22.84 | 25.80 |
| Width of skull at posterior edge of *meatus aud. externus* | 322.00 | 276.00 | 296.00 |
| Width of skull at posterior edge of *meatus aud. externus* in o/o of basal length | 63.76 | 57.57 | 63.65 |
| Width of skull on a level with the upper posterior premaxillary suture | 161.00 | 167.00 | 165.00 |
| Width of skull on a level with the upper posterior premaxillary suture in o/o of basal length | 31.88 | 35.15 | 35.48 |
| Least frontal width of skull | 81.00 | 79.50 | 68.50 |
| Least frontal width of skull in o/o of basal length | 16.03 | 16.73 | 14.73 |
| Length of nasals | 62.00 | 95.00 | 96.50 |
| Combined width of nasals | 58.00 | 58.50 | 55.00 |

South Georgia and Macquarie Island, but it must be borne in mind that all save one were from young animals. From the zygomatic breadth of the two incomplete skulls it may be assumed that their length would be nearly equal to the largest South Georgia ones, and the previously mentioned skulls measured by Townsend and Huey exceed in this dimension. It may be noted that the crania of two adult females from Guadalupe surpass by 60 and 35 mm. Lönnberg's South Georgia example.

In the South Georgia specimens as well as in the Guadalupe ones the greatest relative zygomatic width occurred in quite young animals. It is, therefore, of significance that while the zygomatic breadth of only one adult or semi-adult from South Georgia fell below 70 per cent of the basal length, only one (an immature female) from Guadalupe Island had a zygomatic breadth of more than 70 per cent.

Six of Lönnberg's series have the relative width of skull at the posterior edge of the *meatus auditorius externus* more than 64.84 per cent, the highest attained by all but one young from Guadalupe. Specimens from South Georgia and Macquarie Island, measured by the author, and Turner's Heard Island skulls are 63.76, 57.57, 63.65, 64.4, and 61.2, however.

The length of palate in the Guadalupe elephant seals varied in relation to the basal length from 40.80 (young) to 52.83 per cent. Even the smallest of Lönnberg's series did not fall below 45.0 per cent, and three exceeded 52.83 per cent. The Macquarie Island animals measured by the writer proved to have a relative palatal length of 53.26 and 56.02, but the one measured by Lydekker was 52.7 per cent.

The width of palate in Lönnberg's series varies from 37.1 to 32.2 per cent of basal length, and the same measurement in the Guadalupe specimens is from 32.2 to 28.61 per cent. Skulls measured by Lydekker had a palatal breadth varying from 35 to 39.3 per cent, and 36.12 and 36.42 are the percentages of the Macquarie Island skulls given in the table above.

It might have been supposed that the width of skull at the level of the upper posterior premaxillary suture might bear

close relationship to the palatal breadth, but this did not manifest itself in the measurements. The variations in that dimension in the Guadalupe examples easily fall within the limits of those of the southern seals.

In the case of the least frontal width of skull, a decided difference between the northern and southern animals is evident. That measurement in South Georgia and Macquarie skulls ranges from 20.5 to 14.73 per cent of the basal length, with the exception of one of 12.2 per cent, and from 15.1 to 13.6 in Heard Island examples. The percentage in Guadalupe ones is from 14.07 to 11.75.

It is unfortunate that the proportionate measurements of the two larger incomplete Guadalupe Island skulls are not available for comparison, as they might have made it possible to attain a fairer estimate of the northern elephant seal. The comparisons would also be of greater value were it known how nearly similar in age were the animals whose skulls were the source of the figures. From a study of the measurements presented in these tables, however, and those recorded by Lydekker and Lönnberg, it would appear that, although many of its cranial dimensions fall within the range of variation exhibited by the elephant seal of the southern oceans, the Guadalupe animal possesses a relatively narrower skull. Whether degeneration, due to the near approach of the northern race to extinction, is a factor involved in the reduction in breadth is a debatable point.

The extent of variability manifested in the form of the skull and its component parts makes any decision based upon a limited series of slight value. One character believed to be sufficiently constant to separate the northern from the southern animals was discovered. In Guadalupe Island examples, it was found that in the dorsal aspect the premaxillæ as they extend backward also expand laterally, the lateral outline being distinctly convex in its basal half. The southern specimens examined all appear to have the lateral margins of the premaxillæ parallel.

It would seem, therefore, that there is sufficient justification for regarding the northern elephant seal as a separate species, *Macrorhinus angustirostris*.

In the examination of the Academy's series of specimens certain other skeletal and anatomical characters have been noted which seem of sufficient value to record. Although it is not so pronounced a feature as in the South Georgia and Macquarie Island skulls, the premaxillary tubercle is present in all the Guadalupe specimens. In this latter series the meseth-moid has never been seen to reach the upper surface of the skull as it does in the southern specimens. The pterygoid processes of the Academy's specimens are inclined to be small and rather slender. The skull of one of the females (No. 1137) has both palatines divided into two parts by a suture. In the skull of the male pup (No. 961), probably only a few weeks old, is seen indications of the cranial element found by Cleland[16] in *Cystophora cristata* and other Pinnipedia, and believed by him to correspond to the paroccipital of Owen in osseous fishes.

There is great individual variation in the dentition of the Academy's Guadalupe series, its extent being evident in the following formulæ:

| | | | | |
|---|---|---|---|---|
| I. $\frac{2-2}{1-1}$; | C. $\frac{1-1}{1-1}$; | P.M. $\frac{4-4}{4-3}$; | M. $\frac{0-0}{1-0}$; | C. A. S. No. 962 female |
| I. $\frac{2-2}{1-1}$; | C. $\frac{1-1}{1-1}$; | P.M. $\frac{4-4}{4-4}$; | M. $\frac{1-1}{0-0}$; | C. A. S. No. 1139 male |
| I. $\frac{2-2}{1-1}$; | C. $\frac{1-1}{1-1}$; | P.M. $\frac{4-4}{4-4}$; | M. $\frac{1-1}{1-0}$; | C. A. S. Nos. 1136 and 879 males |
| I. $\frac{2-2}{1-1}$; | C. $\frac{1-1}{1-1}$; | P.M. $\frac{4-4}{4-4}$; | M. $\frac{1-1}{1-1}$; | C. A. S. Nos. 963 and 961 (pup) males |
| I. $\frac{2-2}{1-1}$; | C. $\frac{1-1}{1-1}$; | P.M. $\frac{4-4}{4-4}$; | M. $\frac{1-1}{1-2}$; | C. A. S. No. 1137 female |
| I. $\frac{2-2}{1-1}$; | C. $\frac{1-1}{1-1}$; | P.M. $\frac{4-4}{4-4}$; | M. $\frac{1-1}{2-2}$; | C. A. S. No. 1138 young female |

[16] Rept. Brit. A. A. S., 1902, pp. 646-647.

The vertebral formula of the Guadalupe specimens appears to be: cervical, 7; dorsal, 15; lumbar, 5; sacral, 3; caudal, 9. The absence of a tenth caudal vertebra may, however, be due to mischance in the preparation of the skeleton. In comparison with corresponding parts figured by Turner[17] the spinous process of the cervical vertebræ is much elevated. This character is evident even in the vertebræ of a pup. The hypapophysial tubercle of the atlas is well developed, and the lateral laminæ are considerably depressed apically, giving the lower margin of that vertebra a very sinuous outline. The breadth of the anterior articular surfaces of the axis appears to be proportionately small. The spinous process of the atlas of Nos. 1139, male, and 1137, female, resembles that figured by Turner, but this process in the other males is decidedly broader. The centrum of the third cervical is more nearly oval or elliptical oval. In the seventh vertebra, the transverse processes are not depressed apically as are they in Turner's example. In no case would a straight line drawn between their lowest apices touch the lower margin of the centrum.

On the ventral surface of only the anterior and posterior dorsal vertebræ is evidence of a keel discovered. The bodies of the lumbar vertebræ are slightly flattened, or, in some instances, double keeled so that a ventral groove is formed.

In No. 1136, male, the epiphyses of the first and second, and the second and third sacrals are anchylosed to one another, but not to the centra. In No. 1137, female, the three sacral vertebræ and anchylosed, and in No. 962, female, four vertebræ in the sacral region are fused.

In the Academy's series the first and second caudal vertebræ are possessed of a neural arch. One specimen has the arch present in three, and another specimen has the laminæ of the third caudal nearly united to form an arch, and the fourth is very deeply grooved.

The scapulæ of the Guadalupe seals exhibit considerable variation in form, which is made evident in the following table:

[17] Voy. Challenger, Zoology, XXVI, Seals, pls. II-IV.

| Sex | Greatest depth | Greatest width | Percentage of width in depth |
|---|---|---|---|
| Females..... | 115.00 | 122.00 | 106.08 |
| | 207.00 | 192.00 | 92.75 |
| | 205.00 | 205.00 | 100.00 |
| Males..... | 180.00 | 173.00 | 96.11 |
| | 195.00 | 210.00 | 107.69 |
| | 250.00 | 265.00 | 106.00 |
| | 235.00 | 240.00 | 102.12 |

The skins in the Academy collection were examined and a count of the vibrissæ made. The arrangement of the brow bristles differs, but there are usually eight to ten in the group. A single bristle is found on each side of the median line of the head about halfway between the nostril and eye. The mystacial bristles are arranged in seven rows, the total number varying from 46 to 49. In this regard there seemed to be such a marked difference between these numbers and those given by Allen[18] that the result was verified by count of the papillæ on the under surface of the hide. It appears that the number of maxillary bristles of the Guadalupe Island animals is considerably greater than that of the South Georgia ones. Murphy[19] found that his specimens exhibited 39 maxillary bristles on each side.

I am pleased to acknowledge indebtedness to Dr. G. Dallas Hanna, Curator, Department of Paleontology, and Mr. Joseph Mailliard, Curator Emeritus, Department of Ornithology and Mammalogy, for the photographs used in illustrating this paper.

[18] U. S. Geol. Surv., Misc. Pub., XII, p. 743.
[19] Bull. Am. Mus. Nat. Hist., XXXIII, p. 76.

## Plate 25

Fig. 1. Northern Elephant Seal, male. Guadalupe Island, Mexico, July 12, 1922. Photograph by G. Dallas Hanna.

Fig. 2. Northern Elephant Seal, male. Guadalupe Island, Mexico, July 12, 1922. Photograph by G. Dallas Hanna.

Fig.1

Fig.2

## Plate 26

Fig. 1. Anterior surface of atlas of *Macrorhinus angustirostris*. Photograph by Joseph Mailliard.

Fig. 2. Anterior surface of axis of *Macrorhinus angustirostris*. Photograph by Joseph Mailliard.

Fig. 3. Anterior surface of third cervical vertebra of *Macrorhinus angustirostris*. Photograph by Joseph Mailliard.

Fig. 4. Anterior surface of seventh cervical vertebra of *Macrorhinus angustirostris*. Photograph by Joseph Mailliard.

Fig.1

Fig.2

Fig.3

Fig.4